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A CASE STUDY

Spawn production of oyster mushroom and its processing: An techno - economic feasibility

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ABSTRACT

Mushroom cultivation is of recent origin in India. It is mainly cultivated on the hills as it requires low temperature for its growth; however with the advent of modern cultivation technology it is now possible to cultivate this mushroom seasonally under uncontrolled conditions and throughout the year by employing environmentally controlled conditions. In the last fifteen years, large numbers of commercials units have been built by the entrepreneurs throughout the country for the production of oyster mushrooms. But presence of more than 90 per cent moisture content, they are highly perishable and start deteriorating immediately after harvest. They develop brown colour on the surface due the enzymatic action of phenol oxidase, this result in shorter shelf-life. In view of their high perishable nature, the fresh mushroom have to be processed to extend their shelf-life for off season use by adopting appropriate post – harvest technology to process surplus mushrooms into novel value – added products. The total cost of spawn production was 45.87 Rs. /kg, of which fixed cost constitute .67 Rs. /kg and variable cost was 45.30 Rs. / kg Break Even Quantity of spawn production and Break Even Returns were 2417 kg. and Rs. 142120, respectively. The per piece total cost of mushroom spring roll production and mushroom bread roll were Rs. 16.90 and Rs. 15.48, respectively. Amongst total cost of production cost maximum cost incurred on raw material, followed by labour charges in both the process products. Benefit cost ratio of Himgiree Hi – Tech Agro was 1.24 which is greater than one. Internal rate of return was 26%. It shows that this project is financially feasible.

KEY WORDS : Oyster cultivation, Spawn production, Processing, Shelf – life, Value – added

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Cultivation of oyster mushroom (*Pleurotus ostreatus*) was initiated on experimental basis in Germany by Flack during the year 1917 on tree stumps and wood logs. Cultivation of different varieties of oyster mushroom was initiated in India in the early sixties. Commercial cultivation began in mid-seventies. Mushrooms are the premier recyclers on the planet. Fungi are essential to recycling organic wastes and the efficient return of nutrients back into the ecosystem. Not only are they recognized for their importance within the environment, but also for their effect on human evolution and health (Paul, 1993).

Analysis of fresh oyster mushroom show that they contain 90 to 93 per cent moisture, On a dry weight basis,

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Oyster Mushrooms have substantial protein, ranging from 15-35 % and contain significant quantities of free amino acids. They are replete with assorted vitamins such as vitamin C (30-144mg per 100 g) and vitamin B, niacin (109 mg per 100 g) (Cheung, 1998).

The oyster mushroom has a very high fibre and protein content thus optimum for people suffering from diabetes and obesity cutting down on carbohydrates and fats. Also the minerals like calcium and phosphorus which are in abundance in oyster mushroom than any other protein makes it up a staple diet of the human balanced diet. This mushroom owing to its protein and potassium content helps in constipation and even help to reduce blood pressure and the cholesterol levels in the body making it a true exotic paradise not only because of its extravagant velvety and mild flavor but also because of its high nutritional value (Cheung, 1998). Mushrooms are known to be medically active in several therapies, such as antitumour, antibacterial, antiviral, haematological and immunomodulating treatments (Wasser, 2002; Lindequist *et al*., 2005). The consumption of mushrooms can make a valuable addition to the often unbalanced diets of people in developing countries (Elaine and N.G (Tan) Nair, 2009).

Thus Mushrooms are an ideal food ever for patients, old people, pregnant ladies and children. The world's largest button mushroom growing unit is located in India (Punjab). The present Production of all types of Mushroom in India is 2,50,000 tonnes in 2015. World's total production of mushroom is about 3.41 million tones with China contributing the lions share (FAO Statistics 2011).

Mushroom cultivation requires cereal straws for substrate preparation and there is abundant cereal straw available in India for recycling to edible biomass of highly nutritional and medicinal value. India produces 600 million tonnes of agricultural waste per annum by farmers, which can partly be utilized by the farmers for mushroom cultivation (2012 Market Survey). Mushroom Cultivation is a beneficial technology because it solves two major problems simultaneously *i.e.* waste accumulation and shortage of proteinaceous food (Kulshreshtha *et al*., 2013).

Spawn is any form of mycelium that can be dispersed and mixed into a substrate (Paul, 1993). Spawn is the vegetative mycelium from a selected mushroom grown on a convenient medium or a substrate (Klingman, 1950). Wheat seeds were used as a substrate to produce mushroom spawn.

This present study was conducted on Spawn Production of Oyster Mushroom and its Processing: An Techno – Economic Feasibility.

Objectives :

– To study cost and return structure of Himgiree Hi – Tech Agro.

– To study the economic feasibility of Spawn Production and Mushroom Process Product.

METHODOLOGY

The scope of the study is limited to Spawn production and Mushroom Processing and their techno economic Feasibility. The present study was conducted on the Himgiree Hi – Tech Agro is based on primary data. The primary data were collected through a direct interview schedule through a well designed questionnaire. In addition to this, BEP, BCR, IRR and NPW were calculated for selected study unit. Collected data were analyzed by simple tabular methods Graphical representation and statistical and mathematical tools.

Cost of processing = Total fixed cost + Total variable cost

BEP = Fixed cost / (Selling price per unit – Variable cost per unit)

BCR = Present worth benefit / Present worth cost

NPW = Σ (Discount factor × Net income)

ANALYSIS AND DISCUSSION

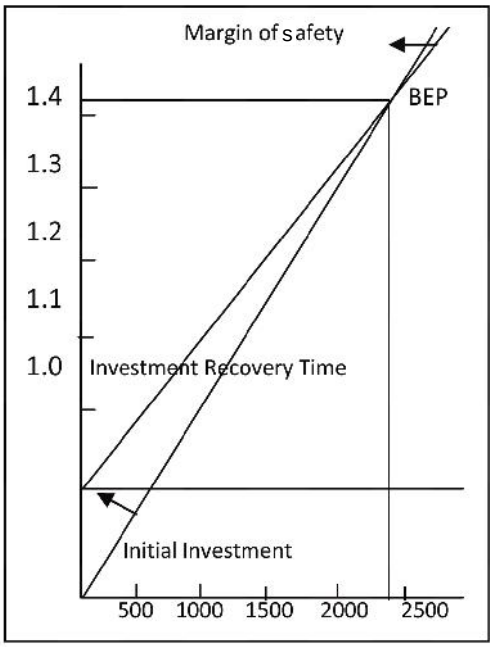
The findings of the present study as well as relevant discussion have been summarized under the following heads and Table 1 to 7.

Spawn production:

Spawn preparation is highly technical operation and is generally done in laboratory. Spawn was prepared usually on Wheat grains. The grains were washed and soaked in water overnight. The water was changed often to prevent fermentation. Once the grains have been prepared, they were boiled till they become soft but remain firm, then the water was drain and spread on a clean cloth. Calcium carbonate (2%) was mix with the grains. These grains were filled in half litter size; empty bottles to three-fourths their capacity. These grains were sterilized in an autoclave for 30 min at 121°C temperature and 15 psp (Pascal pressure). Inoculation was carefully

Table 1 : Per unit cost of spawn production

Particulars	Amount (Rs.)	Percentage	Graphical presentation of BEP
Fixed cost			
Depreciation on building	15000	0.62	
Depreciation on equipments	17200	0.71	
Depreciation on furniture	100	0.00	
Interest on fixed assets	3230	0.13	
Total fixed cost	35530	1.47	
Fixed cost per kg	0.67		
Variable cost			
Raw material	1320000	54.49	
Packaging material	258720	10.68	
Fuel charges	52800	2.18	
Electricity charges	14400	0.59	
Labour charges	360000	14.86	
Transportation and packing	52800	2.18	
Water charges	6000	0.25	
Maintenance	3000	0.12	
Loss in preparation	63360	2.62	
Interest on variable cost	255729.60	10.56	
Total variable cost	2386809.60	98.53	
Variable cost per kg	45.30		
Total cost	2422339.60	100	
Total cost per kg	45.87		



Break even quantity: 2417 kg
Break even return: Rs. 142120

done in total aseptic conditions using pure culture or previously prepared grain spawn. After the inoculation, the bottles were incubated at 25°C temperature for different days. The grains were fully covered by mushroom mycelia and were normally taken from 14 to 20 days after pure mushroom culture inoculation. *i.e.* 18 days. The spawn which is now ready, should be used as soon as possible, otherwise it was compacted with time and make spawning difficult.

Below table shows that, the total cost of spawn production was 45.87 Rs./kg, of which fixed cost constitute .67 Rs./kg and variable cost was 45.30 Rs. / kg. Amongst total cost of production cost maximum cost incurred on raw material (54.49 %), followed by labour Charges (14.86%), Packing Material (10.68 %). Break even quantity of spawn production and break even returns were 2417 kg and Rs. 142120, respectively.

Initial capital investment of mushroom process products were Rs. 275380. Amongst the total initial investment maximum cost incurred on construction of

Table 2 : Initial capital investment of mushroom process product

Sr. No.	Items	Present value (Rs.)	Percentage (%)
1.	Construction of building	150000	54.47
2.	Kitchen equipments		
	Food processor	1600	0.58
	Utensils	4500	1.63
	Weighing balance	1500	0.54
	Sealing machine	1500	0.54
	Storage deep freezer	85000	30.87
	Stove	1280	0.46
	Dryer	30000	10.89
	Total	275380	100

Table 3 : Operating cost of process product

Sr. No.	Particulars	Amount (Rs.)	Percentage
1.	Polythen bag	6000	3.36
2.	Fuel charges	30000	16.79
3.	Labour	24000	13.44
4.	Water	105600	59.12
5.	Electricity	600	0.33
6.	License	2000	1.12
7.	Repair and maintenance	1500	0.84
8.	Loss in processing	8928	4.99
9.	Total	178628	100

building (54.47 %) followed by deep freezer (30.87 %) and dryer (10.89 %).

Annual Operating cost of mushroom process products were Rs. 178628. Amongst the total operating cost maximum cost incurred on water, fuel and labour charges.

Mushroom spring roll :

Process:

Place a large frying pan over high heat and add the oil and butter. Once the butter has melted and begins to froth, add the garlic and ginger paste, cooking for about 10 to 20 seconds or until fragrant. Add the mushrooms, French beans, Green peas, Potato, Carrot stirring to combine, cover and cook for about 10 minutes or until wilted and tender. Add salt, Red chilli power, Garam Masala and lastly, spring onions, then stir to combine.

Begin by making your sealing paste. On a stove top in a small pot or in a bowl, mix the cornstarch and water well and then heat until you get a sticky translucent paste. Remove from heat as soon as the paste starts to form because it gets too sticky very quickly. To assemble spring rolls, orientate the wrapper so it is a diamond in front of you, spoon a heaped tablespoon of mushroom

Table 4 : Per unit cost of mushroom spring roll

Sr. No.	Particulars	Amount (Rs.)	Percentage (%)
	Fixed cost		
1.	Depreciation on building @ 2%	120.9	0.40
2.	Depreciation on equipments and machinery @ 10%	55.28	0.18
3	Interest on fixed cost @ 10%	17.61	0.06
4.	Total fixed cost	193.79	0.64
5.	Fixed cost per pieces	0.1	
	Variable cost		
6.	Raw material	19615.50	64.45
7.	Polythene bags	1209	3.97
8.	Electricity	241.8	0.79
9.	Fuel charges	937.2	3.08
10.	Water charges	241.18	0.79
11.	Labour charges	4255.68	13.98
12.	License	80.6	0.26
13.	Repairing of equipments	60.45	0.20
14.	Loss in processing	359.80	1.18
15.	Interest on variable cost @ 12%	3240.15	10.65
16.	Total variable cost	30241.36	99.36
17.	Variable cost per pieces	16.80	
18.	Total cost	30435.15	100
	Total cost per pieces	16.90	

mixture onto the middle of a spring roll wrapper, spreading it out into an elongated mass. Fold corner over filling, then the edges towards the centre so the parcels are about 10 cm wide to enclose filling and roll into a sausage. Before the final rotation and sealing it, place a sage leaf on the spring roll and seal the corner with a dab of the cornflour and water mixture. Repeat the process with remaining wrappers. Deep fry the spring roll until they are golden.

Quantity of raw material per kg of mushroom spring roll:

Mushroom (200 g), Flour (400 g), Salt (10 g), Red Chilli Powder (50 g), French beans (50 g), Garam Masala (10 g), Green Peas (50 g), Ginger Paste (5 g), Potato (100 g), Carrot (10 g), Cumin Seeds (5 g), Onion Garlic Masala (5 g).

The total cost of mushroom spring roll production was Rs. 30435.15. Per piece total cost was Rs. 16.90. amongst total cost of production cost maximum cost incurred on raw material (64.45 %), followed by labour charges (13.98 %).

Mushroom bread roll :

Process:

In a large bowl, mix warm water, yeast, and 1/3

Table 5: Per unit cost of mushroom bread roll

Sr. No.	Particulars	Amount (Rs.)	Percentage (%)
	Fixed cost		
1.	Depreciation on building @ 2%	120.9	0.43
2.	Depreciation on equipments and machinery @ 10%	55.28	0.20
3	Interest on fixed cost @ 10%	17.61	0.06
4.	Total fixed cost	193.79	0.70
5.	Fixed cost per pieces	0.1	
	Variable cost		
6.	Raw material	17553	62.95
7.	Polythene bags	1209	4.34
8.	Electricity	241.8	0.87
9.	Fuel charges	937.2	3.36
10.	Water charges	24.18	0.09
11.	Labour charges	4255.68	15.26
12.	License	80.6	0.29
13.	Repairing of equipments	60.45	0.22
14.	Loss in processing	359.8	1.29
15.	Interest on variable cost @ 12%	2966.68	10.64
16.	Total variable cost	27688.99	99.30
17.	Variable cost per pieces	15.38	
18.	Total cost	27882.78	100
	Total cost per pieces	15.48	

Table 6 : BCR and IRR calculations **(Rs. In Lakh)**

Year	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	Total
Capital cost	2.8	0	0	0	0	0	0	0	0	0	0	0	0	2.8
Working capital	3	0.44	0.7	0.88	1.1	1.31	1.53	4.51	5.1	6.24	8.63	10.07	30.2	73.69
Total cost	5.8	0.44	0.7	0.88	1.1	1.31	1.53	4.51	5.1	6.24	8.63	10.07	30.2	76.49
Benefit	0.6	0.8	1.2	1.6	2.0	2.7	3.15	5.6	6.1	8.57	16.4	20.24	43.1	111.37
Net benefit	-5.2	0.36	0.5	0.72	0.9	1.39	1.62	1.09	0.9	2.33	7.73	10.17	12.9	35.48
PWC @ 15 % DF	5.04	0.33	0.43	0.5	0.54	0.6	0.58	1.47	1.45	1.5	1.85	1.88	4.91	21.1
PWB @ 15 % DF	0.52	0.6	0.79	0.91	0.99	1.2	1.18	1.83	1.72	2.1	3.52	3.78	7.01	26.2
NPW	5.04													
BCR	1.24													
IRR	26 %													

cup honey. Add 5 cups white bread flour, and stir to combine. After mixing add 3 tablespoons melted butter, 1/3 cup honey, and salt. Punch down the dough and divide into 3 loaves. Bake at 350 degrees F (175^0 C) for 25 to 30 minutes; do not over bake.

Quantity of raw material per kg of mushroom bread roll:

Mushroom (350 g), Flour (500 g), Soya Sauce (15 g), Butter (10 g), Active Dry Yeast (10 g), Honey (5 g) and Salt (15 g).

The total cost of mushroom bread roll production was Rs. 27882.78. Per Piece total cost was Rs. 15.48. Amongst total cost of production cost maximum cost incurred on raw material (62.95 %), followed by labour Charges (15.26 %).

Benefit cost ratio of Himgiree Hi – Tech Agro was 1.24 which is greater than one. Internal rate of return was 26%. It shows that this project is financially feasible.

Table 7 : SWOT analysis

Strengths	Weaknesses
Varity of products	Weak processed product awareness
Nearby city and market	
Opportunities	Threat
Widening of market	New entries
Export potential	Low consumption of mushroom
Creating brand image in mushroom market	

Conclusion :

Mushrooms can make a valuable dietary addition through protein and various micronutrients and, coupled with their medicinal properties, mushroom cultivation can represent a valuable small –scale enterprise option (Elaine and N.G (Tan) Nair, 2009).In view of high perishable nature of fresh mushrooms have to be processed to extend their shelf-life for off season use. This can be achieved by adopting appropriate post harvest technology to process surplus mushrooms into novel value added products. The value – added products are the need of the hour for the mushroom growers not only to reduce the losses but also to enhance the income by value – addition and boost the consumption of important horticultural crop.

The total cost of spawn production was 45.87 Rs. / kg, of which fixed cost constitute .67 Rs. / kg and variable cost was 45.30 Rs. / kg Break even quantity of spawn production and break even returns were 2417 kg and Rs. 142120, respectively.

The per piece total cost of mushroom spring roll and mushroom bread roll production were Rs. 16.90 and Rs. 15.48, respectively. Amongst total cost of production cost maximum cost incurred on raw material, followed by labour charges in both the process products.

Benefit cost ratio of Himgiree Hi – Tech Agro was 1.24 which is greater than one. Internal rate of return was 26%. It shows that this project is financially feasible. Strength of Himgiree Hi Tech Agro are variety of products, location is nearby city and market. Opportunities for this unit are widening of market, export potential and creating brand image in mushroom market.

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